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NARRATIVE REVIEW

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Point-of-care ultrasound for aiding diagnosis of congestive heart failure in the emergency department: A narrative review

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Abstract

Background: Congestive heart failure (CHF) is a common condition that causes significant diagnostic challenges in the emergency department (ED). Rapid and accurate diagnosis is crucial for the effective management of CHF and improving patient outcomes. This narrative review aims to provide a state-of-art review to summarize the current application of PoCUS for aiding the diagnosis of CHF in ED.

Method: A targeted literature search in the databases of Ovid (Medline and Embase) and PubMed was performed. The search filters were set to "full text," "English", and "15 years."

Result: One hundred sixty-four journal articles were retrieved; the articles were reviewed by the author to decide whether they were relevant to this narrative review or not. Finally, 16 articles were selected.

Conclusion: Point-of-care ultrasound (PoCUS) including focused cardiac, lung, and venous ultrasound plays a pivotal role in aiding the diagnosis of CHF in ED. These modalities offer rapid, noninvasive, and bedside assessments that are helpful in the emergency department setting.

KEYWORDS
congestive heart failure, diagnosis, emergency department, ultrasound

1 | INTRODUCTION

Congestive heart failure (CHF) is a common condition that causes significant diagnostic challenges in the emergency department (ED). Rapid and accurate diagnosis is crucial for the effective management of CHF and improving patient outcomes. However, it is well known that both the clinical history and physical findings are nonspecific and not sensitive. In view of that, point-of-care ultrasound (PoCUS) has emerged as a valuable diagnostic tool in the ED for aiding the diagnosis of CHF, providing a readily assessable, real-time, and noninvasive insights into the patient's cardiac function as well as fluid status. This narrative review aims to provide a state-of-art review[1] to summarize the current application of PoCUS for aiding the diagnosis of CHF in ED.

2 | METHOD

A targeted literature search in the databases of Ovid (Medline and Embase) and PubMed was performed. The search items for Ovid (Medline and Embase) were

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"congestive heart failure" AND "diagnosis" AND "ultrasound" AND "emergency department." For PubMed, using the same search items came out with more than 1000 results. Therefore, the search item in PubMed was using "PoCUS" instead of "ultrasound" to get better and more targeted results. The search filters were set to "full text," "English", and "15 years."

3 | RESULT

The search was performed online on 10/08/2024. The results were Ovid retrieved 108 journal articles, while PubMed retrieved 56 journal articles. The total 164 journal articles were reviewed by the author to see whether they were relevant to this narrative review. Finally, 16 journal articles were selected and the results were summarized in Table 1.

4 | DISCUSSION

This narrative review synthesizes the existing studies and research of various PoCUS modalities in aiding the diagnosis of congestive heart failure in emergency department. In summary, the PoCUS modalities are mainly focused cardiac ultrasound (FoCUS), lung ultrasound (Lung PoCUS), and venous ultrasound (Venous PoCUS) for fluid status (Table 1). We will have a review of each PoCUS modalities below.

4.1 | Focused cardiac ultrasound

From the literature search, focused cardiac ultrasound (FoCUS) constitutes the main diagnostic aiding tool for the acute heart failure in the emergency department. Different from the formal echocardiogram performed by cardiologists which need thorough and extensive training for years, the technique and knowledge of FoCUS can be obtained in a much shorter period of time. The FoCUS performed by emergency physician (EP) is a targeted examination with the scope of providing a rapid, goal-directed scan to answer a specific clinical question. The ultrasound machine used is usually small, portable, and even hand-held one. EP generally uses the basic 2D B-mode images with some Doppler scans if necessary. The scan usually took 5–10 min to perform instead of the formal echocardiogram which needs 30–60 min to complete. There are many FoCUS protocols found in the literature; one of the most popular is the "5E" FoCUS protocol which provides an easy-to-learn and standardized approach for EP to assess the patient in the emergency setting. The "5E" includes the pericardial Effusion, left ventricular Ejection, ventricular Equality (chamber size), Exit (aortic root), and Entrance (inferior vena cava).[17]

For the congestive heart failure, literature reviews showed that the commonly used FoCUS parameters by EP are the left ventricular ejection fraction (LVEF), followed by DTE (deceleration time of E-wave), E/A ratio (the ratio of the early - E wave, to late - A wave, ventricular filling velocities.), and E/e' (ratio between early mitral inflow velocity and mitral annular early diastolic velocity).[2–8]

4.2 | LVEF

EP usually assesses LVEF using visual estimation, E-point septal separation (EPSS) as well as Velocity time integral (VTI). A systematic review and meta-analysis performed by Albaroudi et al. found that there was a substantial agreement between EP and expert sonographer for assessing LVEF using visual estimation and ranking it as normal (EF > 50–55%), reduced (EF > 30–55%), and severely reduced (EF<30%) in patients presenting to ED.[18]

For the visual estimation of LVEF by EP, the views used include the parasternal long axis view (PLAX), parasternal short axis view (PSAX), and apical 4-chamber view (A4C). An optimal PLAX view should include the left ventricle, right ventricular outflow tract (RVOT), septum, and both the aortic and mitral valves. Besides visual estimation for the difference in left ventricular size between systole and diastole, EP can also use PLAX to assess the EPSS. Since PLAX can provide a good visualization of the anterior leaflet of the mitral valve, they can have a visual estimation of EPSS by observing whether the anterior leaflet is touching the ventricular septum or not during a systole. They can also measure the actual value of the EPSS by M-mode. An EPSS value greater than 7 mm (>7 mm) signified a reduced LVEF, while an EPSS value greater than 12 mm (>12 mm) signified a severely reduced LVEF[19] (Figure 1).

PSAX view at the level of papillary muscles is another optimal window to assess the LV function. By looking at the difference in chamber size between the systole and diastole, we can have a visual estimation of the LVEF. The same concept applies to the A4C view too.

Concerning the limitations and pitfall about LVEF visual estimation, one should carefully obtain the LV view at the widest diameter of the LV chamber to avoid misestimation. For instance, in an oblique view, one will underestimate the chamber size and hence overestimate its emptying. Besides, focal wall motion abnormalities and underlying arrhythmias like atrial fibrillation and premature ventricular contractions will also affect the accuracy. In such cases, we should observe the LVEF in different views and more cardiac cycles. For EPSS, on the other hand, the accuracy can be affected by the pathologies in the mitral valve, aortic valve, and septum. Patients with atrial fibrillation will

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TABLE 1 Journal articles reference to the application of PoCUS to aid the diagnosis of congestive heart failure in the emergency department.

Author/ Year (ref.)	Ultrasound modality	Symptom/ Disease	Study type	Sample size	Setting/ Country	Result
Nazerian/ 2010[2]	Cardiac: • LVEF • E/A ratio • DTE	Acute dyspnea/HF	Prospective cohort study	145	ED/Italy	Sensitivity: 82% Specificity: 90% Accuracy: 75%
Anderson/ 2013[3]	Cardiac: • LVEF Lung: • B-line IVC: • Collapsibility	Acute dyspnea/HF	Prospective observational cohort study	101	ED/USA	Sensitivity: 36% Specificity: 100% PPV: 100% NPV: 67% accuracy: 72%
Russell/2015[4]	Cardiac: • LVEF • E/e' Lung: • B-line • Pleural effusion IVC: • Diameter • Collapsibility	Acute dyspnea/HF	Prospective observational study	99	ED/USA	Sensitivity: 83% Specificity: 83% LR + ve: 4.8 LR-ve: 0.2 Accuracy: 83%
Dehbozorgi/ 2019[5]	Cardiac: • LVEF • E/e' Lung: • B-line • Pleural effusion IVC: • Diameter • Collapsibility	Acute dyspnea/HF	Interventional study	100	ED/Islamic republic of Iran	Sensitivity: 64% Specificity: 97% LR + ve: 23.14 LR-ve: 0.37 accuracy: 88%
Umuhire/ 2019[6]	Cardiac: • LVEF Lung: • B-line • Pleural effusion IVC: • Collapsibility	Acute dyspnea	Prospective, observational study	99	ED/Rwanda	Diagnostic accuracy for HF increased from 53.8% to 100%
Vauthier/ 2021[7]	Cardiac: • MAPSE • E/A • E/e' Lung: • B-line	Acute dyspnea/HF	Prospective, observational study	103	ED/France	Sensitivity: 96% Specificity: 93% LR + ve: 12.7 LR-ve: 0.05 AUC: 0.94
L'Hermitte/ 2024[8]	Cardiac: • MAPSE • E/A • E/e' • DTE Lung: • B-line	Acute dyspnea/HF	Prospective observational study	166	ED/France	Sensitivity: 87% Specificity: 95% LR + ve: 18.1 LR-ve: 0.14 AUC: 0.91

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TABLE 1 (Continued)

Author/ Year (ref.)	Ultrasound modality	Symptom/ Disease	Study type	Sample size	Setting/ Country	Result
Liteplo/2009[9]	Lung: • B-line	Acute dyspnea/HF	Prospective, observational study	94	ED/USA	Sensitivity: 58% Specificity: 85% LR + ve: 3.88 LR-ve: 0.5
Al Deeb/ 2014[10]	Lung: • B-line	Acute dyspnea/CHF	Systematic review and meta-analysis	1075	ED/Canada	Sensitivity: 94.1% Specificity: 92.4% LR + ve: 12.4 LR-ve: 0.06
Chiem/2015[11]	Lung: • B-line	Acute dyspnea/HF	Prospective, cross-sectional study	392	ED/USA	Sensitivity: 85% Specificity: 84% LR + ve: 5.2 LR-ve: 0.2
Msolli/2021[12]	Lung: • B-line	Acute dyspnea/HF	Cross-sectional prospective study	700	ED/Tunisia	Sensitivity: 82.5% Specificity: 83.9% LR + ve: 5.12 LR-ve: 0.2
Miller/2011[13]	Vein: • IVC • Caval index • Caval-aortic ratio	Acute dyspnea/HF	Prospective observational study	89	ED/USA	Caval index<33% Sensitivity: 80% Specificity: 81% Caval-aortic ratio Sensitivity: 33% Specificity: 96%
Gaskamp/ 2016[14]	Vein: • IVC	Acute dyspnea/HF	Review of 4 studies	310	ED/Tahlequah	Sensitivity: 37%–93% Specificity: 84%–96%
Darwish/ 2020[15]	Vein: • IVC	Acute heart failure (AHF)	Systematic review and meta-analysis	1472	ED, IP, OP/America	Statistically significant difference existed with and without AHF.
Batsheva/ 2018[16]	Vein: • IJV	Acute dyspnea/HF	Prospective observational study	59	ED/Israel	Sensitivity: ~70% Specificity: ~70%
Jang/ 2011(17)	Vein: • IJV	Acute dyspnea/HF	Prospective observational study	119	ED/USA	Sensitivity: 99% Specificity: 59% LR + ve: 2.4 LR-ve: 0.01

Abbreviations: AUC, area under the receiver operating characteristic curve; DTE, deceleration time of E-wave; ED, emergency department; E/A = E-wave velocity/ A-wave velocity; E/e', E: peak early mitral inflow velocity; e′: peak early diastolic mitral annular velocity; HF, heart failure; IJV, internal jugular vein; IP, inpatient; LVEF, left ventricular ejection fraction; LR + ve, positive likelihood ratio; LR−ve, negative likelihood ratio; OP, outpatient; NPV, negative predictive value; PPV, positive predictive value.

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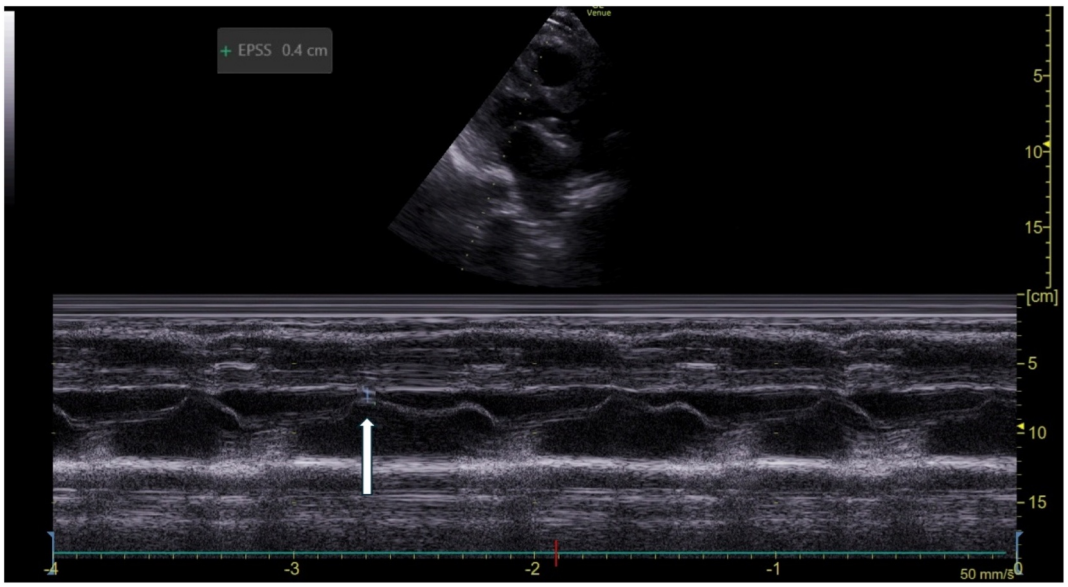

FIGURE 1 EPSS is measured in the PLAX view, and the white arrow indicates the EPSS 4 mm which is normal. EPSS, E-point septal separation; PLAX, parasternal long axis view.

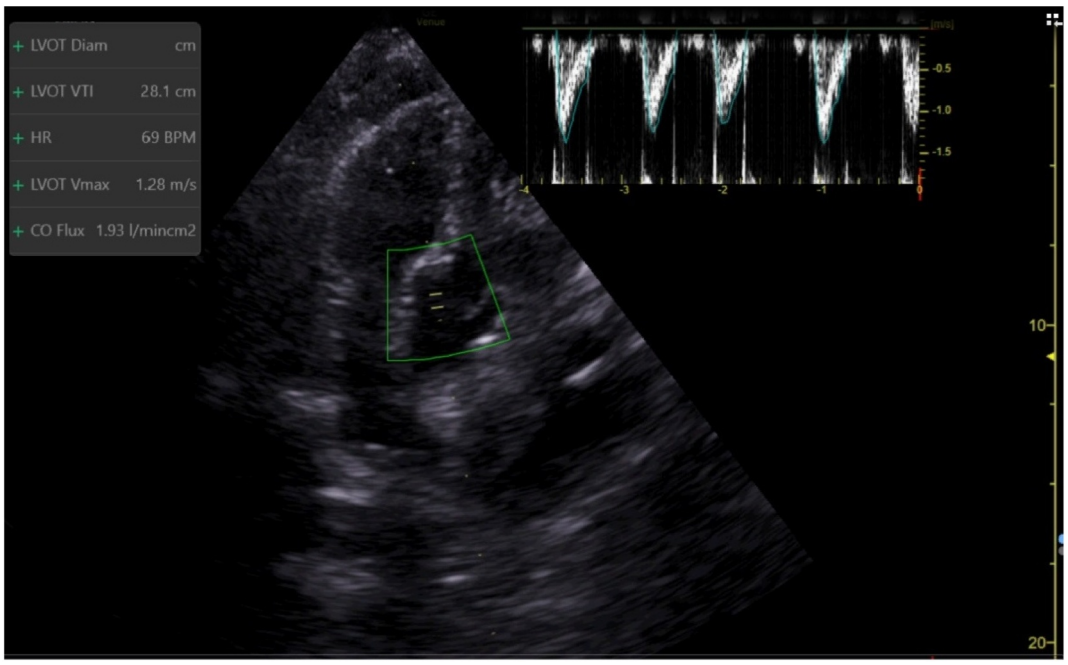

FIGURE 2 : VTI measured at the left ventricular outflow tract (LVOT) in the apical 5-chambers view using auto-VTI function of the ultrasound machine. VTI, velocity time integral.

have beat-to-beat variation of EPSS and we should take more cardiac cycles to interpret too.

Some EP will use the velocity time integral (VTI) to assess the cardiac function. VTI is an easily acquired parameter which can help to estimate the patient's stroke volume and cardiac output. Several applications of VTI in ED including differentiate the type of shock, determine fluid responsiveness, and provide risk stratification. The normal value of VTI is between 17 and 23 cm. Below this range (<17), one should consider cardiogenic, obstructive, or hypovolemic causes. Above this range (>23), distributive shock like septic shock should be pursued. In the context of aiding the diagnosis of congestive heart failure in ED, however, it needs to be interpreted together with other FoCUS parameters. As with EPSS, VTI also has its limitations; the presence of atrial fibrillation, moderate to severe aortic regurgitation, and conditions that cause subaortic obstruction like asymmetric left ventricular hypertrophy will affect its accuracy[20] (Figure 2).

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4.3 | Focused cardiac Doppler

In addition to VTI, more and more emergency physicians find that Doppler echocardiography is not exclusive by cardiologists. Some selected skills can be manipulated by EP and aiding the diagnosis and improve patient management. The E wave deceleration time (DTE) is one of the focused cardiac Doppler that is used in ED. DTE is the time interval from the peak of the early diastolic trans-mitral flow velocity (E wave) to its return to baseline. It reflects the rate at which the left atrium and left ventricle pressure equalizes during early diastole. Normal DTE typically ranges between 160 and 200 ms.[21] DTE with value > 200 ms often indicates an impaired relaxation of the left ventricle and is a sign of diastolic dysfunction. This is particularly relevant for diagnosing heart failure with preserved ejection fracture (HFpEF). DTE <160 ms, on the other hand, indicates a restrictive filling pattern, which is associated with elevated left atrial pressure and often seen in advanced severe heart failure.[2,7,22]

The E/A ratio is another valuable parameter in focused cardiac Doppler for aiding the diagnosis of heart failure in ED. E wave represents the early diastolic filling of the left ventricle, while A wave represents the late diastolic filling due to atrial contraction. The E/A ratio is the ratio of the peak velocity of E wave to the peak velocity of A wave, which is measured using pulse wave Doppler at the mitral valve. The E/A ratio normally ranges from 1 to 1.5 in a healthy adult. Deviation from the normal range can indicate diastolic dysfunction, which is a key feature of heart failure. The reduced E/A ratio (<1) indicates the impaired relaxation of the left ventricle, often seen in early stages of diastolic dysfunction and heart failure with preserved ejection fraction (HFpEF). The elevated E/A ratio (>2), on the other hand, suggests a restrictive filling pattern, which is associated with increased left atrial pressure and advanced diastolic dysfunction, usually found in severe and late-stage heart failure[2,7,23] (Figure 3).

Besides the E/A ratio, E/e' ratio is also a widely used parameter. E/e' is the ratio of early mitral inflow velocity to mitral annular velocity. The E/e' ratio provides an estimate of left ventricular filling pressure. Its normal range lies between 8 and 15. An elevated E/e' ratio indicates increased left ventricular filling pressure which is a hallmark of diastolic dysfunction. This is particularly useful for diagnosing heart failure with preserved ejection fracture (HFpEF).[7,8]

Although focused cardiac Doppler is relatively easy to use by EP, we should note that there are some limitations. Some patient-specific factors such as age (elderly), heart rate (tachycardia), irregular rhythm (atrial fibrillation), preload/afterload condition, mitral/aortic valves pathologies as well as regional wall motion abnormalities may influence the accuracy.[2,7,8,24]

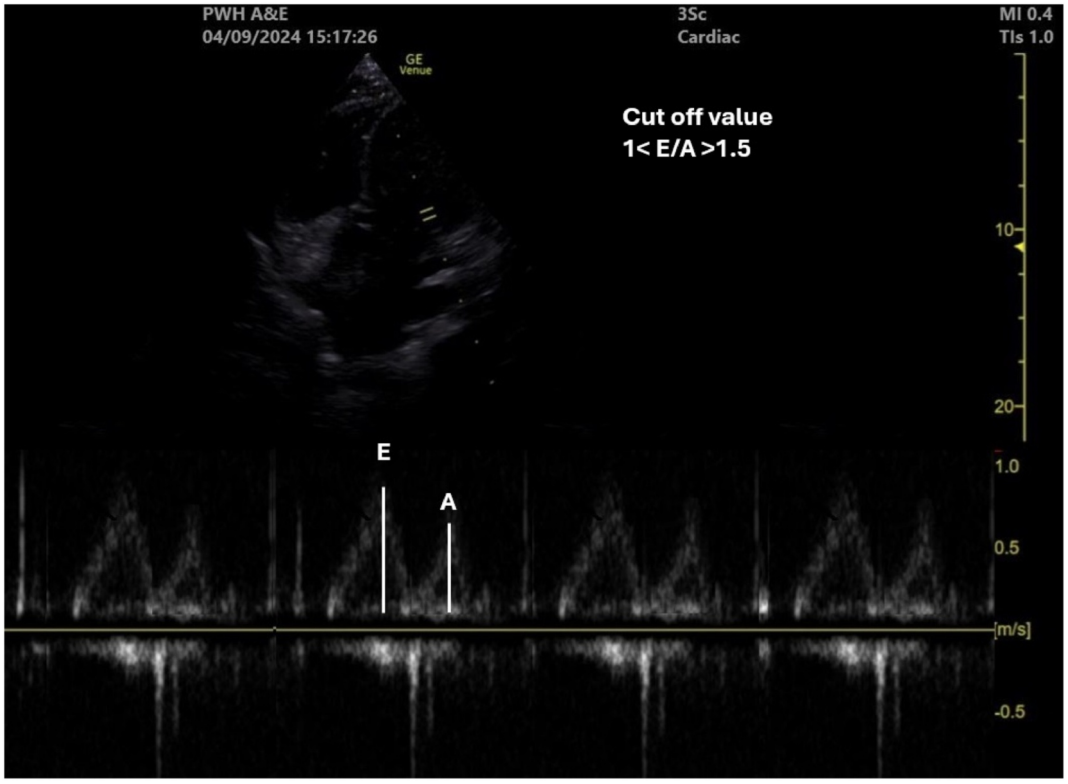

FIGURE 3 E/A ratio measured the flow velocity ratio across the mitral valve in a A4C view. A4C, apical 4-chamber view.

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4.4 | Point-of-care lung ultrasound (lung PoCUS)

Over the past 2 decades, the development and application of lung ultrasound in emergency department become more and more popular and important. Its usefulness in aiding the diagnosis of acute heart failure is also being evaluated in many studies. Systemic review and meta-analysis showed that lung PoCUS can aid EP to diagnose acute cardiogenic pulmonary edema and also acute heart failure. The sensitivity and specificity are as high as 94.1% and 92.4%, respectively.[10]

The concept of lung ultrasound relies on the artifacts created by air–tissue interfaces. The lungs are primarily composed of air-filled alveoli, which create a significant acoustic impedance mismatch with the surrounding tissues. This results in strong reflections and characteristic artifacts on ultrasound images. We interpret lung ultrasound mainly on such artifacts instead of direct visualization of lung parenchyma. The key artifacts are namely the A-lines and B-lines.

A-lines refer to horizontal, repetitive lines that are equidistant from the pleural line. They indicate a normal aerated lung tissue. The presence of A-lines suggests that there is no significant interstitial or alveolar fluid. B-lines refer to vertical, comet-tail artifacts that arise from the pleural line and move with respiration. They extend to the bottom of the screen without fading. The presence of multiple B-lines (more than three per intercostal space) indicates interstitial syndrome such as pulmonary edema, which is common in congestive heart failure (Figure 4).

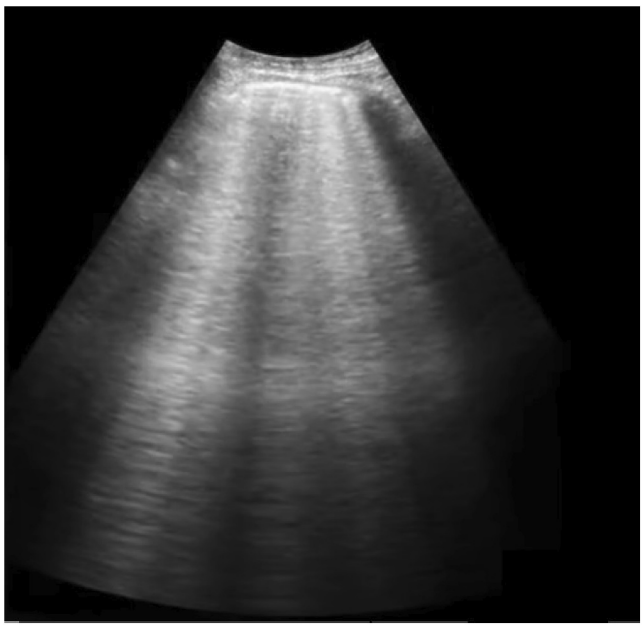

FIGURE 4 Image showed multiple B-lines indicating significant interstitial or alveolar fluid.

In performing the scan for B-lines, some authors used the 12-region approach[7,8] while some used the 8-region one.[6,12] All use the B-profile as the standard of positive scan. The presence of three or more B-lines in a region is considered as positive in that region, at least two regions in each lung for B-profile to be defined.[25] It should be noted that in BLUE protocol, only the B-line in anterolateral regions will be considered, as the one in posterior regions can be due to gravity alone. The B-profile suggests the presence of acute hemodynamic pulmonary edema with 97% sensitivity and 95% specificity.[26]

In this narrative review of the studies using lung ultrasound (B-profile) as the main diagnostic tool of acute heart failure, the sensitivity ranged from 58% to 94.1%, while the specificity ranged from 83.9% to 92.4%.[9–12] According to the results of the other studies using combined cardiac (FoCUS), lung (B-profile), and venous (IVC) ultrasound, the sensitivity was 36%–96% and the specificity was 83%–100%.[2–5,7,8] Therefore, in order to improve the diagnostic accuracy of acute heart failure, a combination of cardiac (FoCUS), lung (B-profile), and venous (IVC) ultrasound should be considered.

There are some limitations of using lung ultrasound (B-lines) to diagnose acute heart failure.

Firstly, B-lines are not specific to heart failure. They can also be seen in other conditions such as interstitial lung disease, acute respiratory distress syndrome (ARDS), pneumonia, and pulmonary fibrosis. This nonspecificity can lead to diagnostic confusion if the result is not interpreted in the appropriate clinical context. Secondly, it is operator ,dependency. The accuracy of detecting and interpreting B-lines depends heavily on the operator's skill and experience. Thirdly, the result may be influenced by the patient factors like obesity, chest wall deformities, or subcutaneous emphysema, making it difficult to obtain clear ultrasound images, potentially leading to false negatives or poor-quality assessment. Besides, rapid or shallow breathing can also affect the visualization of B-lines, making it challenging to obtain consistent and reliable results.[26]

Lung ultrasound (B-profile) is a valuable adjunct tool in aiding the diagnosis of acute heart failure. However, its result should be interpreted as part of a comprehensive assessment, including clinical history, physical examination, and other diagnostic tests such as cardiac (FoCUS) and venous (IVC) ultrasound as well as biomarkers like brain natriuretic peptide (BNP).

4.5 | Venous ultrasound (venous PoCUS)

Venous ultrasound involves the use of 2D B-mode as well as Doppler scan to assess the venous blood flow, its variability with respiration, and the waveform. It is noninvasive, readily available, and provide real-time information about the patient fluid status. The key

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areas of focus in venous ultrasound for acute heart failure include the inferior vena cava (IVC), internal jugular vein (IJV), hepatic vein, portal vein, and renal vein. Many studies showed that venous ultrasound can provide a useful diagnostic and prognostic adjunct to acute heart failure.[13–17,27]

Inferior vena cava, the IVC, is the most frequent and intensively evaluated one. In a spontaneously breathing patient, intrathoracic pressure will decrease during inspiration causing an increase in venous return to the heart and collapse of IVC. The reverse will occur in expiration. Measuring the IVC diameter and its collapsibility index (IVC-CI) will provide some insights into central venous pressure and fluid volume status. In patient with fluid overload or heart failure, the IVC will distend and become less variable with respiration. Researchers use these characteristics of IVC to assess its correlation with acute heart failure. A systemic review by Darwish concluded that a statistically significant difference existed in the IVC parameters between patients with and without acute heart failure. It also found that based on the results of meta-analysis, an IVC diameter on expiration (IVC exp) > 2.0 cm and IVC-CI < 30% are reasonable cutoffs to suggest that a patient with acute dyspnea is more likely to have acute heart failure (AHF) than non-AHF condition. On the other hand, patient with an IVC exp <1.5 cm and IVC-CI >50% is unlikely to have AHF. The use of these cutoffs to suggest AHF will have the sensitivity and specificity of greater 80%[16] (Figure 5).

Internal jugular vein, the IJV, is the second common vein used to evaluate its relationship with acute heart failure. The diameter and collapsibility of the IJV provide some reflection about central venous pressure (CVP). An enlarged IJV with reduced collapsibility suggests elevated CVP and hence right atrial pressure (RAP), which is common in heart failure. There are different ways in measuring IJV when assessing its relationship with acute heart failure. Jugular meniscus level, JVD ratio (ratio of the maximum cross-sectional diameter of the IJV during Valsalva to the diameter at rest), IJV-RVD (IJV respiratory variation diameter), and IJV/CCA ratio (ratio of IJV and common carotid artery) are some parameters used.[16,27,28]

A study by Jang et al. found that for the IJV meniscus level ≥ 8 cm, the sensitivity of identifying patients with congestive heart failure (CHF) was 99% (95% CI, 92.2%–100%) and the negative likelihood ratio (LR-ve) was 0.01 (95% CI, 0.0007–0.20). They concluded that for patient with IJV meniscus level ≤ 8 cm should not be assumed to have CHF as the primary cause of their symptoms and an alternative diagnosis should be considered.[27]

The role of other venous ultrasound like hepatic vein, portal vein, and renal vein has also been studied. The main principle is to use Doppler scan to look for the

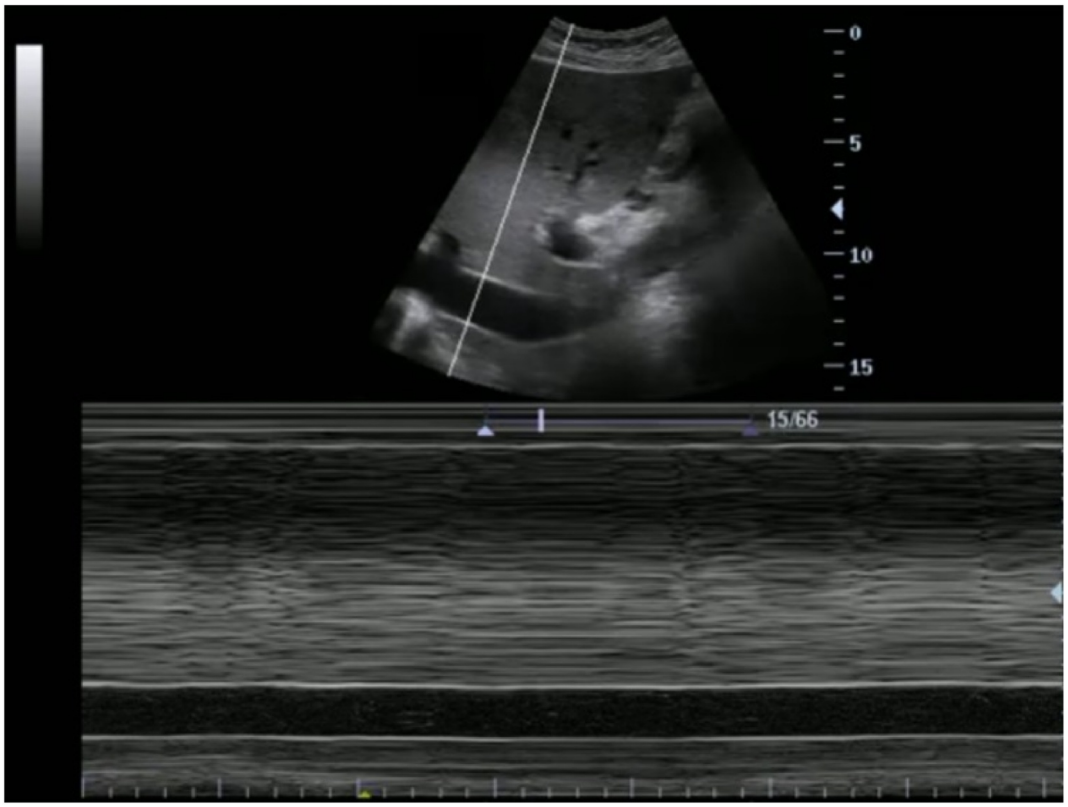

FIGURE 5 IVC in M mode showed lack of collapsibility with respiration.

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venous congestion and aid in the diagnosis of congestive heart failure. In hepatic vein, increased pulsatility in hepatic vein can indicate elevated right atrial pressure and systemic venous congestion. This is often seen in patients with congestive heart failure. Waveform analysis also give some clues, Doppler scan assess the S-wave (systolic) and D-wave (diastolic) patterns. In congestive heart failure, the S-wave may be diminished or reversed, indicating elevated right heart pressure. In porta vein and renal vein, the pulsatility and flow pattern also give some information about the right atrial pressure and aid in the diagnosis of congestive heart failure.[29,30]

Although venous ultrasound provides valuable information for diagnosing congestive heart failure, it has its limitations. Besides the operator and patient factors which can affect the accuracy of the scan, the basic principle of venous ultrasound is to identify venous congestion which itself is not specific to heart failure. It can also be seen in other conditions such as liver cirrhosis, renal failure, and pulmonary hypertension. Therefore, venous ultrasound should be used as part of a comprehensive assessment, including history, physical examination, and other diagnostic tests. The findings should be interpreted in the context of the patient's overall clinical picture to avoid misdiagnosis and inappropriate management.

5 | CONCLUSION

Point-of-care ultrasound (PoCUS), including focused cardiac, lung, and venous ultrasound, plays a pivotal role in the diagnosis and management of congestive heart failure (CHF). These modalities offer rapid, noninvasive, and bedside assessments that are crucial in the emergency department and other acute care settings.

Focused cardiac ultrasound (FoCUS) provides a rapid estimate of the cardiac function, allowing for the evaluation of left ventricular systolic function, detection of pericardial effusion, and assessment of volume status through measurements of the inferior vena cava (IVC). This helps in identifying heart failure and guiding treatment decisions.

Lung ultrasound (LUS) is instrumental in detecting pulmonary congestion, a hallmark of heart failure. The presence of B-lines and pleural effusions can quickly indicate pulmonary edema, aiding in the differentiation of heart failure from other causes of dyspnea.

Venous ultrasound, particularly the assessment of the IVC, hepatic veins, portal veins, and renal veins, provides valuable information on venous congestion and central venous pressure. The venous excess ultrasound score (VExUS) combines these measurements to offer a comprehensive evaluation of systemic congestion, which is critical in diagnosing and managing acute heart failure.

Despite their numerous advantages, these ultrasound techniques have limitations, including operator dependency, technical challenges, and the need for comprehensive clinical correlation. However, when used as part of a multimodal approach, PoCUS significantly enhances diagnostic accuracy, guides effective treatment, and improves patient outcomes in congestive heart failure.

In summary, the integration of focused cardiac, lung, and venous ultrasound (Triple PoCUS) into clinical practice represents a powerful advancement in the rapid and accurate diagnosis of congestive heart failure, ultimately leading to better patient care and management.

AUTHOR CONTRIBUTIONS

The single author, Dr. Tsui Chi Leung, contributed to all parts of this narrative review article.

ACKNOWLEDGMENTS

Nil.

CONFLICT OF INTEREST STATEMENT

I declared that there was no conflict of interest in this narrative review.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

ETHICS STATEMENT

Ethical review and approval were waived for this study as there were no individual patient data involved.

INFORMED CONSENT

There is no need for informed consent as there is not involved human subjects in this narrative review.

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PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/hkj2.12063.

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